

NOTES ON THE TAXONOMIC HISTORY OF TWO RARE SPECIES OF *BEGONIA* (BEGONIACEAE) FROM SIKKIM HIMALAYA AND THEIR CONSERVATION

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ABSTRACT

Begonia satrapis C.B. Clarke and *B. scutata* Wall. are two rare species known from Eastern Himalaya. *Begonia satrapis* is an endemic of Sikkim and Darjeeling Himalaya, while *B. scutata* is reported to occur in Sikkim and the adjacent Nepal Himalaya. In this contribution we review their collection history, reassess their present conservation status, and identify various threats to their survival in nature. We found that many of the species' populations have disappeared and the existing ones have considerably shrunk to small sizes. *Begonia satrapis* was represented by only three scattered populations in the adjoining localities comprising about 40–50 individuals each. Likewise, *B. scutata* was represented by three populations of about 10–15 individuals each. We suggest urgent *ex situ* and *in situ* conservation measures for saving these species from extinction.

KEY WORDS: *Begonia satrapis*, *B. scutata*, endemic, rare, habitat loss, Sikkim Himalaya

RESUMEN

Begonia satrapis C.B. Clarke y *B. scutata* Wall. Son dos especies raras conocidas del este del Himalaya. *Begonia satrapis* es endemica de Sikkim y Darjeeling, mientras que *B. scutata* se ha citado de Sikkim y el Nepal adyacente. En esta aportación revisamos la historia de sus recolecciones, confirmamos su estatus de conservación actual, e identificamos varias amenazas para su supervivencia en la naturaleza. Hemos encontrado que muchas poblaciones de la especie han desaparecido y las existentes se han reducido considerablemente a tamaños pequeños. *Begonia satrapis* está representada únicamente por tres poblaciones esparcidas en localidades vecinas que contienen unos 40–50 individuos cada una. De modo semejante, *B. scutata* está representada por tres poblaciones de unos 10–15 individuos cada una. Sugerimos medidas de conservación urgentes *ex situ* e *in situ* para salvar estas especies de la extinción.

INTRODUCTION

Sikkim, with a geographical area of 7096 sq km, is a small state of India located in the Eastern Himalaya. Owing to its varied altitudinal gradient (240–8,598 m), diverse habitats and high rainfall, the area supports a rich flora in its tropical, sub-tropical, temperate and alpine ecosystems. This region has been identified as one of the global hot spots of biological diversity (Myers et al. 2000). This rich diversity has of late come under severe pressure and as a result a large number of plant taxa are threatened in this region (Nayar & Sastry 1987, 1988, 1990). Recent studies suggest probability of large scale extinctions of Himalayan plant species following habitat loss (Pandit et al. 2007).

The first assessment of conservation status of Indian plant species about two decades ago (Nayar & Sastry 1987, 1988, 1990), could not be followed by intensive studies on taxa faced with survival risks. With increasing pressures of overexploitation and habitat loss, several species have been restricted to only a few populations and individuals in Eastern Himalaya (Pandit & Babu 1998, 2003). Sikkim Himalaya, particularly, is one of the richest areas of floristic diversity where a number of plant taxa are reported to be facing risk of survival. It is estimated that at least 45 species of flowering plants are known to be facing varying degrees of threat in Sikkim Himalaya (Nayar & Sastry 1987, 1988, 1990; Singh & Chauhan 1998). The habitats are under threat from increasing human population, expanding agriculture and a plethora of developmental activities. In Sikkim, proposed large-scale hydro-power projects along Teesta River and on its tributaries, pose a serious threat to habitats, which are likely to cause unprecedented species population losses if proper care is not taken to rescue them (CISMHE 2007). In view of the impending hydro-power developmental activities

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in Sikkim Himalaya, a survey and assessment of the rare and threatened plant biodiversity in the area was taken up so as to understand the magnitude of their population loss and also to suggest corrective measures.

MATERIALS AND METHODS

During a series of recent plant explorations (2002–2006) in Sikkim Himalaya, we collected specimens of *Begonia* L. from the tropical and sub-tropical regions in South Sikkim (Fig. 1). After critical study, review of literature and consultation of specimens at Central National Herbarium (CAL), Kolkata and Botanical Survey of India, Sikkim Circle, Gangtok, (SHC), our *Begonia* collections were identified as *B. satrapis* C.B. Clarke and *B. scutata* Wall. The locations of the various populations of the two species in Sikkim were mapped using Leica – GS5 GPS (global positioning system). The voucher specimens were deposited in the CISMHE Herbarium, University of Delhi, Delhi, India with duplicates being deposited at the Herbarium of Botanical Survey of India Sikkim Himalaya Circle, Gangtok (SHC) after publication of this study. During the surveys, the habitat conditions, plant associates as well as biotic and abiotic pressures, were recorded in order to assess the threat the *Begonia* populations.

RESULTS

Notes on the taxonomic description, habitat, distribution, population status in the study area, and conservation methods are described below. Illustrations of *Begonia satrapis* and *B. scutata* are provided in Figures 2 and 3, respectively.

Begonia satrapis C.B. Clarke, in Hooker, Fl. Brit. India 2:638. 1879.

Tall pubescent herbs, with a tuberous rootstock. Stem erect or shortly decumbent, 24–28 cm long, usually elongate above the radical leaves. Leaves reniform or ovate-acuminate, 4–9 × 4.5–12 cm, cordate at the base, minutely denticulate, ciliate, closely pubescent above, rufous-villous on the nerves beneath; stipules lanceolate, pubescent. Peduncle elongate, up to 7 cm, densely pubescent; bracts persistent oblong-lanceolate, hairy. *Male flower*: pedicel 1.5–2 cm, pubescent; tepals 2+2, the outer larger, about 1 cm long, pubescent; the inner smaller, 0.5 cm long, glabrous; stamens many, monadelphous; anthers obovoid, 0.1 cm long, connective absent. *Female flower*: pedicel long, about 3 cm, pubescent; tepals 2+3, the outer larger, about 0.6 cm long, pubescent, inner smaller, glabrous; styles 3, separate. *Fruit*: capsule with 3 equal wings, about 1.5 cm long, pubescent. Seeds ellipsoid.

Habitat.—The populations were located around Sumbuk and Kitam, in Rangit Valley (South Sikkim) at altitudes of 550–1100 m. *Begonia satrapis* grows in tropical and sub-tropical mixed deciduous forests consisting of trees like *Callicarpa arborea* Roxb., *Gmelina arborea* Roxb., *Ostodes paniculata* Blume, *Phoenix sylvestris* (L.) Roxb., *Schima wallichii* Choisy, *Shorea robusta* C.F. Gaertn., *Tectona grandis* L.f. and *Terminalia myriocarpa* Van Heurck & Müll-Arg. The species is usually associated with other herbaceous species such as *Ageratina adenophora* (Spreng.) R.M. King & H. Rob., *Capillipedium assimile* (Steud.) A. Camus and *Cymbopogon flexuosus* (Nees ex Steud.) Will. Watson. *Begonia satrapis* prefers shaded rocky forest floors near the forest fringes and the areas along road cuttings. The species is found restricted to a narrow area in the Majitar Forest Block in South Sikkim. The habitat is exploited for harvesting of timber trees, fodder, fuel wood, and other human activities.

Distribution.—Sikkim (Rangit Valley), West Bengal (Darjeeling district).

Population mapping and status.—Only three isolated populations of *B. satrapis* around Sumbuk (lat. 27°6'19"N, long. 88°22'07"E at alt. 550 m; lat. 27°06'06"N, long. 88°23'07"E at alt. 555 m) and Kitam (27°07'42"N and 88°21'04"E at 1100 m) in South Sikkim (Fig. 1) were encountered during the study. Each of these populations comprised 40–50 individuals and the majority of them were in flowering and fruiting stages. However, no seedlings of the species could be located.

Threat.—We observed that the natural habitat of *B. satrapis* is under severe biotic pressure. The number and geographic area of the type localities of the species have been considerably reduced owing to activities like agricultural expansion, road-widening, and fodder collection by the local population.

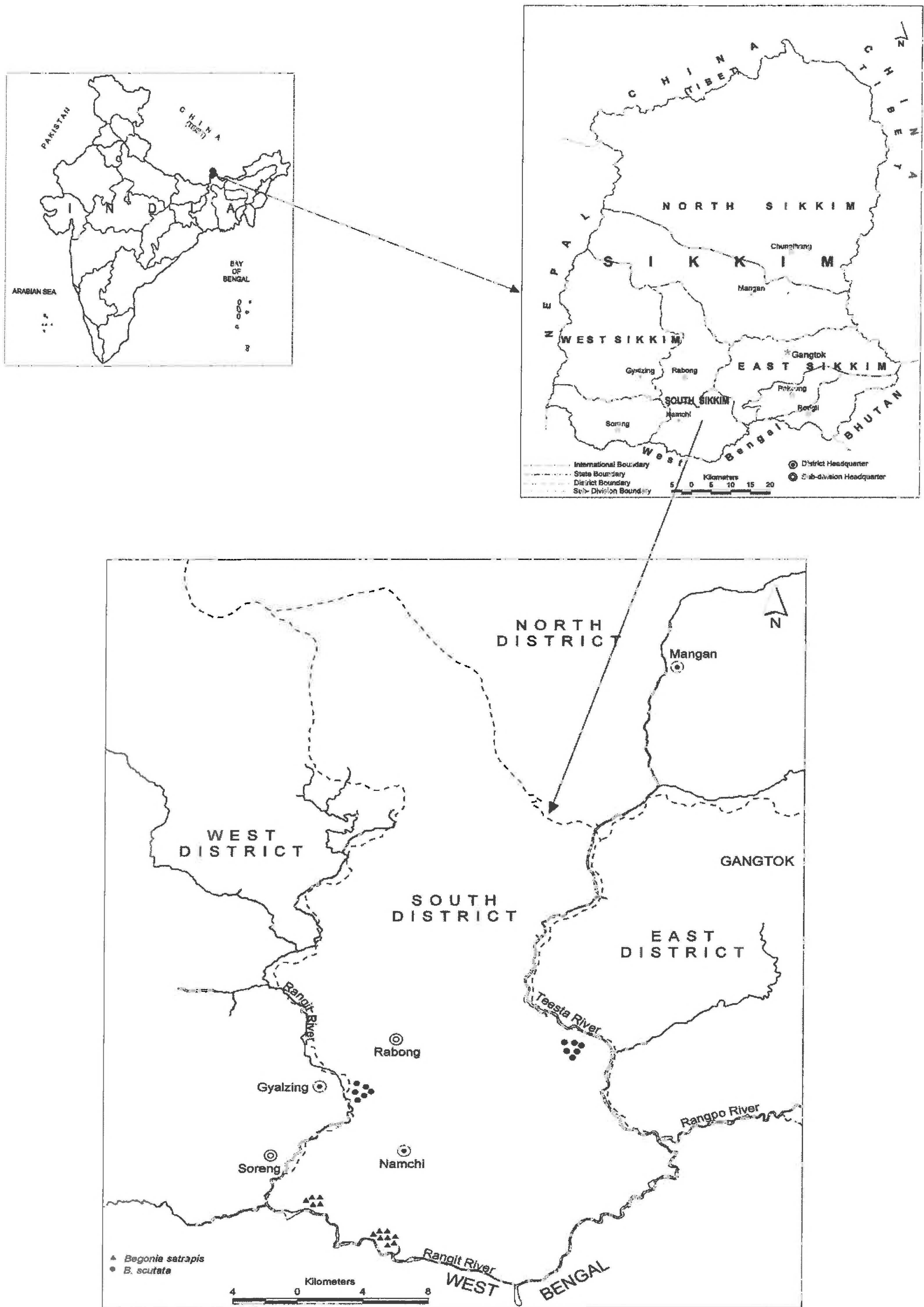


Fig.1. Map of the study area (Sikkim) and location of the populations of *Begonia satrapis* and *B. scutata*. Note that the populations of these two species are restricted to South Sikkim.

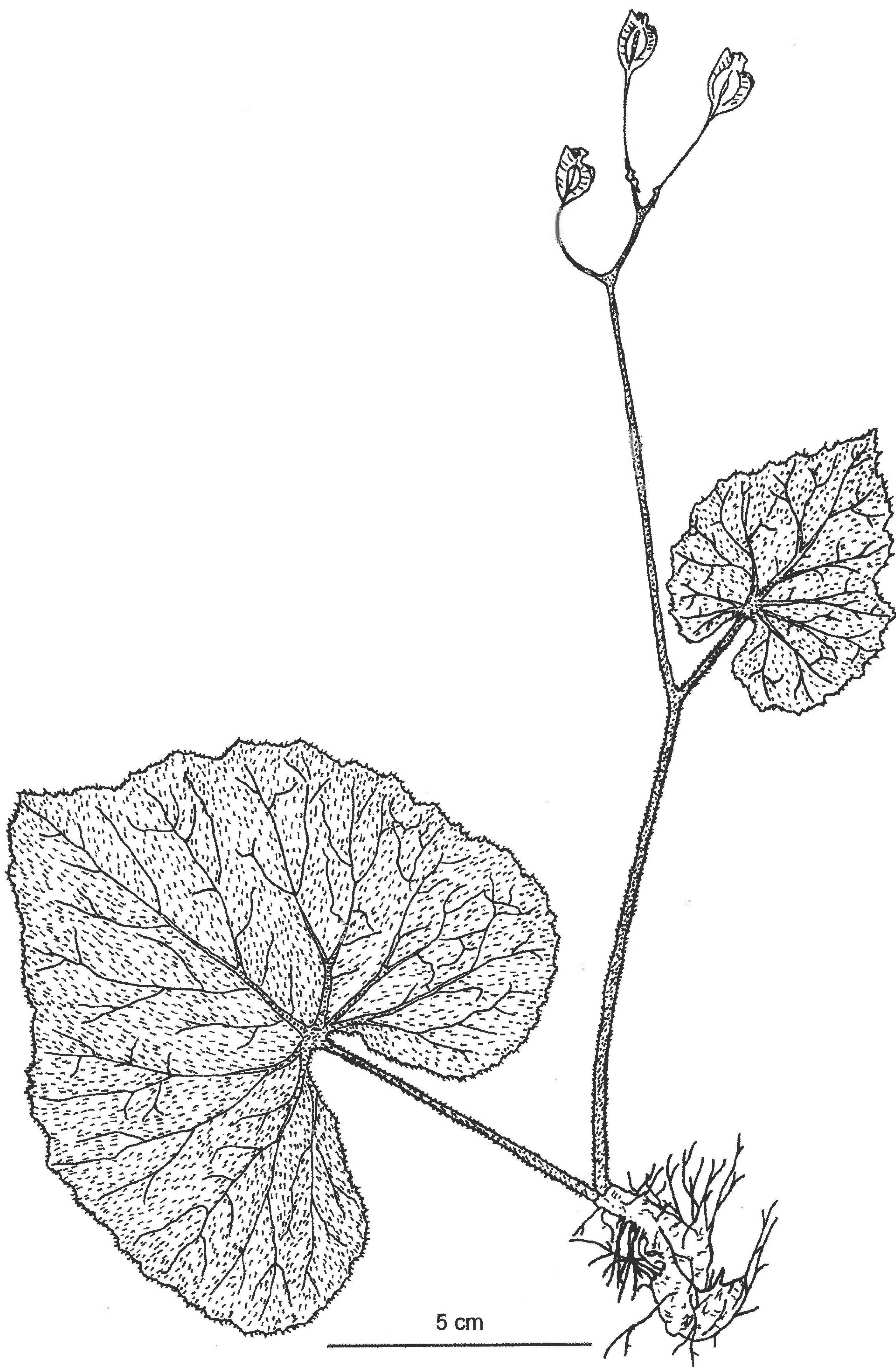


FIG. 2. Line drawing of *Begonia satrapis* C.B. Clarke.

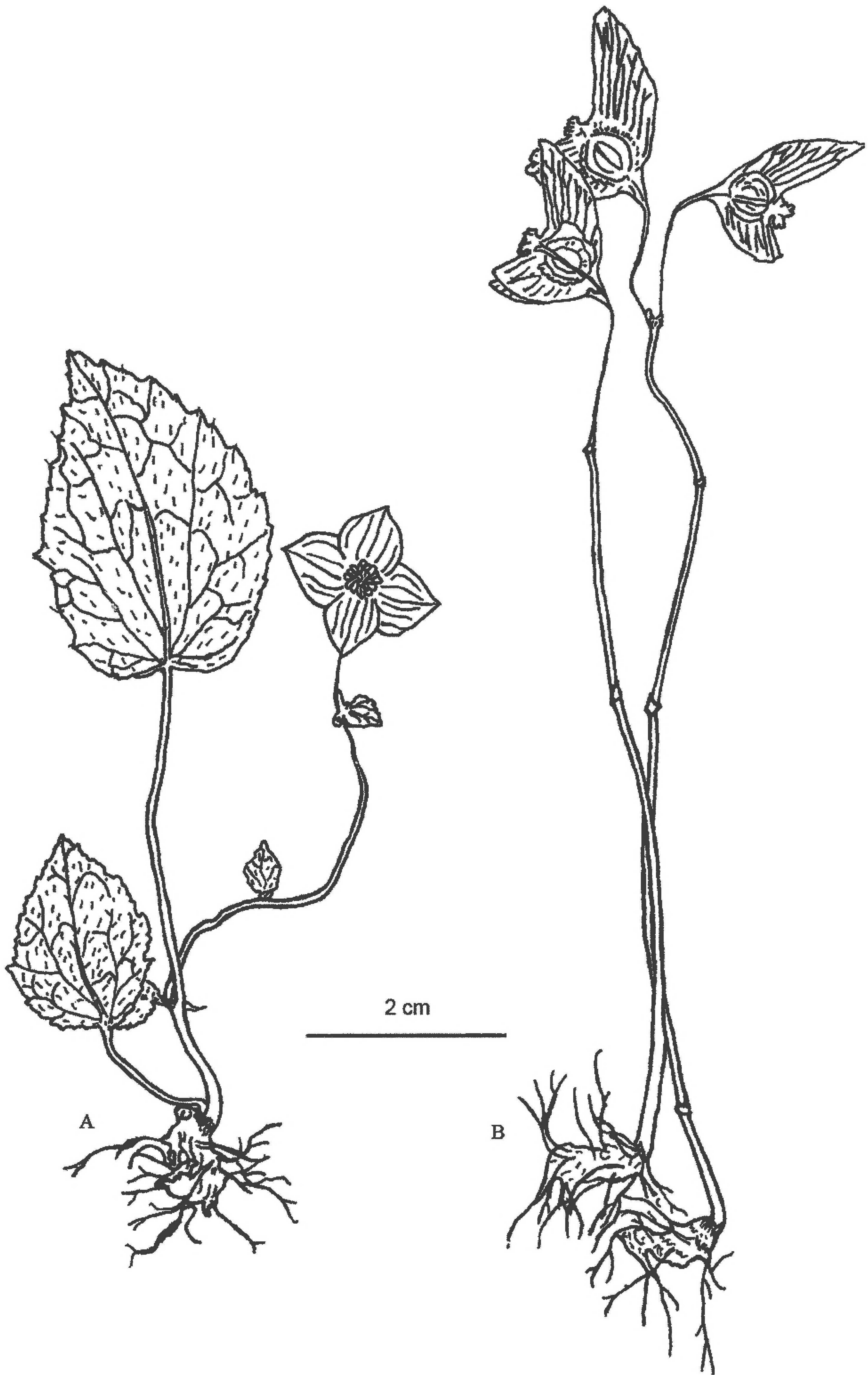


FIG. 3. Line drawing of *Begonia scutata* Wall. Plant with male flower (A) and female plant with capsules (B).

Collection history.—*Begonia satrapis* has not been collected from the Rangit hills since 1910. There are only two herbarium sheets deposited in the Central National Herbarium (CAL) which were collected by Ribu and Rhomo (Griffith Herbarium), from Rangit, dated October 7, 1910 and these are without flowers. Biswas (1966) reported the occurrence of *B. satrapis* from the adjoining (Darjeeling district), West Bengal, however, no voucher specimens were found at CAL and SHC herbaria for reference.

Begonia scutata Wall., Prodr. 15(1):328.1864; Clarke, in Fl. Brit. India 2:642. 1879.

Small, glabrous herbs with a very short tuberous rootstock. Stem erect, filiform, 7–14 cm high, leafless in fruiting stage. Leaves ovate-acute, cordate at base, irregularly serrate margins, minutely pubescent on the nerves beneath; petiole filiform, 2–4 cm long in cauline leaf, longer up to 7 cm in radical leaves. Peduncles 5–7 cm long, 2–3 flowered; bracts caducous. *Male flower*: pedicel about 1 cm long; tepals 2+2, the outer tepals ovate, 1 × 0.8 cm, pubescent, the inner smaller, 0.5 × 0.4 cm, glabrous; stamens about 20, shortly monoadelphous; anthers obovoid. *Female flower*: tepals 2+1, the outer tepals rounded, 0.8 cm in diameter, the inner one smaller, 0.4 cm wide; styles 3, distinct, shortly bifid above. *Fruit*: capsules, unequally 3-winged, the larger wing 0.9 cm wide, smaller wing about 0.2 cm wide. Seeds ellipsoid.

Habitat.—Three populations of *B. scutata* were located near Yangyang in Teesta Valley and Legship in Rangit Valley (South Sikkim) at altitudes of 300–1200 m. These populations inhabited open, tropical, and sub-tropical mixed deciduous secondary forests. The surrounding vegetation in the habitat comprised of trees like *Bombax ceiba* L., *Canarium strictum* Roxb., *Engelhardtia spicata* Blume, *Erythrina arborescens* Roxb., *Garuga pinnata* Roxb., *Gynocardia odorata* R. Br., *Schima wallichii* Choisy and *Toona ciliata* M. Roem. The main herbaceous associates of *B. scutata* include *Begonia picta* Sm., *Cissus repens* Lam., *Didymocarpus pedicellatus* R. Br., *Pilea scripta* (D. Don) Wedd., *Persicaria capitata* (D. Don) H. Gross, *Urtica dioica* L. and *Selaginella aitchisonii* Hieron. *Begonia scutata* grows on sandy, wet soils, and rocky strata.

Distribution.—Himalaya: Sikkim, West Bengal (Darjeeling); Nepal; Peninsular India.

Population mapping and status.—Only three populations of *B. scutata* around Legship (lat. 27°16'25"N, long. 88°16'49"E at 300 m alt.; lat. 27°16'28.27"N, long. 88°16'48"E at 400 m alt.) and Yangyang (lat. 27°16'49"N, long. 88°24'45"E at 1100 m alt.) could be observed in South Sikkim (Fig. 1). Each of these populations comprised 10–15 individuals and the majority of these were in flowering/fruiting stages.

Threat.—The vast forested tracts in the distribution range of the species have already been cleared for agriculture and road construction purposes. The habitats are being continuously disturbed and degraded owing to various activities being undertaken in those areas such as road construction, sand mining, and agricultural expansion.

Collection history.—This species was first collected by Wallich in 1821 and its type specimen is available in CAL. It was later reported from Eastern Himalaya (Sikkim and Darjeeling) by Biswas (1966) and Grierson and Long (1991). Apart from the type (Wallich 1821) only a few other specimens without flowers are available in CAL.

DISCUSSION

Begonia satrapis and *B. scutata* are listed as rare species in the Red Data Book of Indian Plants (Nayar & Sastry 1990). *Begonia satrapis* is a very rare plant and was reported to occur only in Rangit valley in Sikkim Himalaya (Hooker 1879). The CAL specimens of *B. satrapis*—collected by Ribu and Rhomo, G.H. Cave and I.H. Burkil during 1875 to 1914 from the hills of Rangit—are fairly old and do not represent adequate material for its proper identity. Though, Biswas (1966) reported the occurrence of the species from Darjeeling, no specimen of his collections was found at either CAL or SHC. Reports of Grierson and Long (1991) suggest presence of the species in Darjeeling and Sikkim Himalaya. Apart from the type and a few specimens of *B. satrapis* by Ribu and Rhomo (1910), available at CAL, no other specimen of this species has been preserved anywhere in the Indian herbaria. Therefore, the recent collection of these species by the authors after a long gap is noteworthy.

Begonia scutata was first collected by Wallich in 1821 and described by De Candolle in 1864 from Nepal. This species was later reported from Sikkim and Darjeeling Himalaya (Biswas 1966) and Nepal Himalaya (Hara 1966). A collection of the species from a new locality in Peninsular India by Kumar and Banerjee (1989) could not be verified as the specimen of their collection was not found at CAL. Grierson and Long (1991) have recorded this species near Reshap in Darjeeling Himalaya and described it as *B. rubella*. However, our taxonomic evaluation of the specimens and descriptions reveal that *B. rubella* and *B. scutata* are two distinct species (see also Nayar & Sastry 1990). Apart from the type specimen of Wallich (CAL), no other authentic specimen of *B. scutata* was located in other Indian herbaria.

The populations of *B. satrapis* and *B. scutata* in South Sikkim were mapped and various threats faced by these species were assessed. It was observed that the population sizes of the two species are small and their habitats face severe pressure from various anthropogenic activities including road-widening, tree felling, expansion of agricultural fields, grazing, etc. In a recent work, Pandit et al. (2007) have reported that large scale species extinction is likely to occur in Himalaya following deforestation and continuing land use changes. Studies have shown that reduction in the population size occurs due to the human activities in their habitats which lead to the reduction of genetic diversity and rarity of the species (Godt et al. 1998; Di Battista 2007). The present study indicates that *Begonia satrapis* is represented by merely three scattered populations of about 40–50 individuals dispersed over an area of 2–3 sq km each. Additionally, regular collection of fodder and fuel wood from the forest floors by humans seems to be a serious threat to the survival of this species in its natural habitat.

Begonia scutata is represented by only three populations comprising about 10–15 individuals each. These populations survive in the degraded forests along river banks, which are threatened by activities like road construction, sand mining, and agricultural expansion. These habitats are the last bastions of its survival and the species may be consigned to extinction once these habitats are lost. The two species of *Begonia* discussed here are faced with probable extinction. To save these species from being lost efforts are under way to locate more populations of these taxa, multiply them, and re-introduce them in their natural habitats. As such, there is an urgent need for carrying out detailed biological and ecological studies on these species for their proper conservation. To begin with the habitats of these species need to be brought under protective regulation before these species are lost forever. We also recommend that if activities such as road extension, agricultural expansion are unavoidable in these habitats, the last remaining populations of these species must be rescued and rehabilitated to safer habitats within the region.

Ex-situ conservation strategies

Re-establishing wild populations of *B. satrapis* and *B. scutata* in suitable habitats that do not have severe habitat pressure can prove to be an effective means of ex-situ conservation. Since both the species of *Begonia* have limited number of individuals and small population sizes, adequate measures such as cultivating these species in nearby botanic gardens and parks should be undertaken. For a long-term conservation program, establishing seed banks will be essential.

ACKNOWLEDGMENTS

The authors are thankful to H.M. Mukherjee, Central National Herbarium, Kolkata (CAL) for permission and help with the herbarium. The financial support for the research project sanctioned to M.K. Pandit vide project no. J.12011/11/99-IA.I. from the Ministry of Environment, Forests and Wildlife, Government of India and National Hydro-electric Power Corporation, Faridabad, is gratefully acknowledged. Two anonymous reviewers kindly reviewed and thus improved the manuscript.

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